PMM 2019 Science Team Meeting

Updates to the GPM Validation Network: A multi-perspective database to facilitate precipitation science

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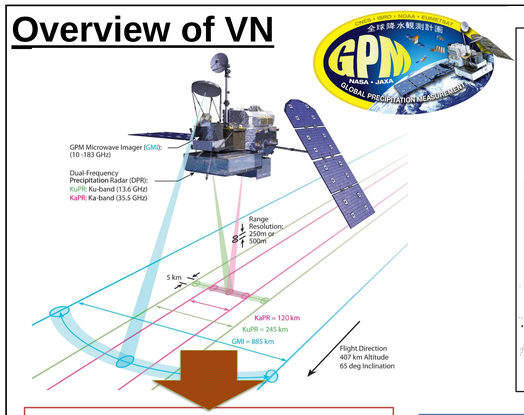
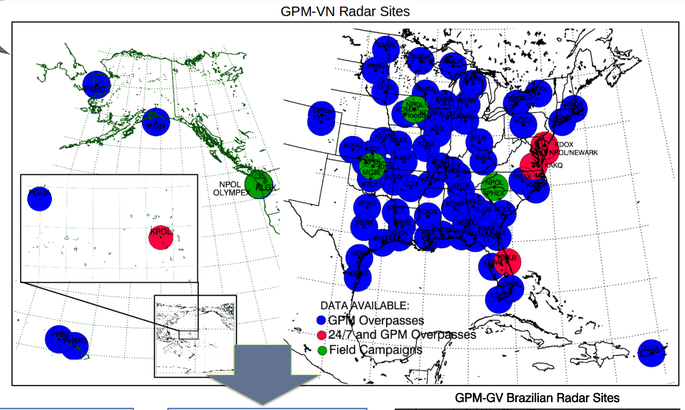
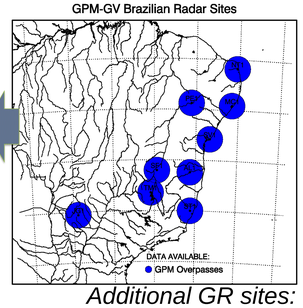
Abstract. A critical component of the Global Precipitation Measurement (GPM) Mission validation strategy involves use of dual-polarimetric (DP) ground-based radar (GR) products. Both operational and research DP radars across the U.S. and several international locations are used with coincident GPM dual-frequency precipitation radar (DPR) data in a signficant expansion of the original TRMM-based "validation network architecture" (VN; Schwaller and Morris, 2011, J.Tech.). The VN radar databases consist of millions of geometrically matched DPR and GR precipitation volumes. Not only does it serve as a tool for validation of satellite-based precipitation retrieval algorithms and GR calibration but also a valuable resource for precipitation science and for complimenting future convective precipitation-related satellite missions.

Overview of VN

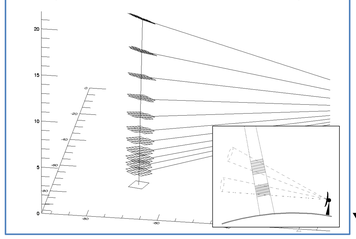






2ADPR (Iguchi et al. 2018)
2BCMB (Olson et al. 2018)
Attenuation Correction
G.V. Retrievals

DPR+GR Volume Matching (Schwaller & Morris 2011)



Retrieval of GVs (Pippitt et al. 2015)
RainRate
DSD
Hydrometeor ID
Field Campaigns

Quality Control (Pippitt et al. 2013)
Automated
Manual

Additional GR sites: La Reunion (MeteoFrance), Darwin-CPOL (BoM/V.Louf/S.Collis),

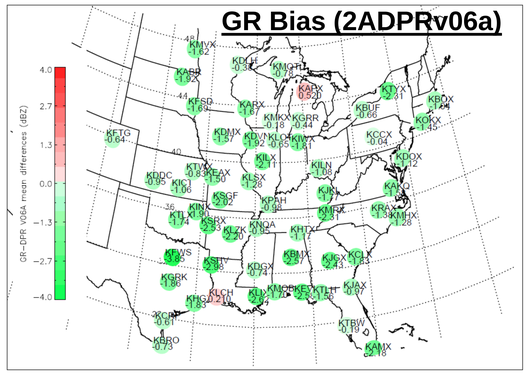
Years: 2014-*2019*

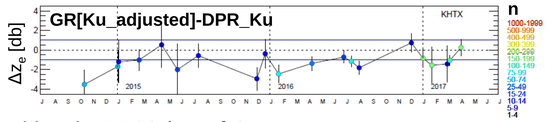
Total number of GR bins Matched	**6,339,462**
HID=Drizzle/Rain	36.8%
HID=Ice Crystals/Vert. Ice	27.2%
HID=Wet Snow	9.9%
HID=Aggregates	7.0%
HID=Hail/HDGR	7.9%
HID=Big Drops	1.7%

Number of Matched Profiles (DPR+GR)	**2,022,983**
Stratiform	75.5%
Convective	12.8%

Based on "100-in-100" criterion: ≥ 40x40km² of DPR pixels with rain ≤ 100-km of GR

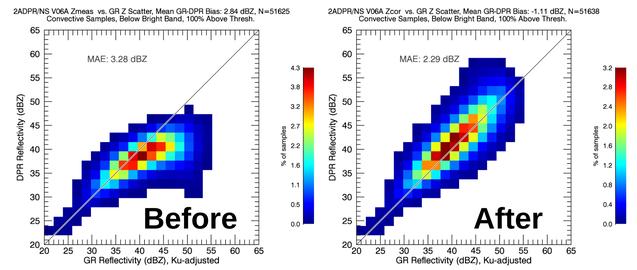
GR Bias (2ADPRv06a)



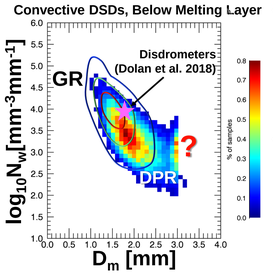


Validation of Satellite Radar Algorithms

Attenuation Correction (2ADPRv6a)

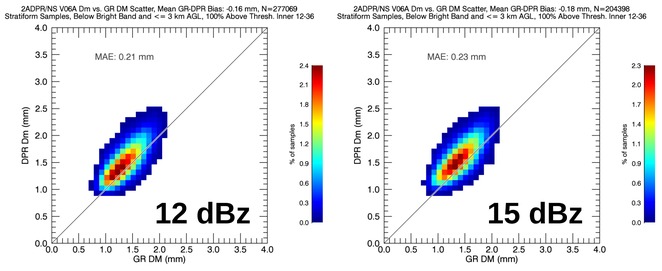


DSD Retrieval (2ADPRv6a)



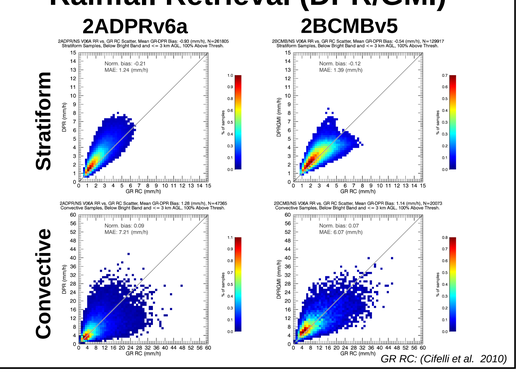
- DPR has high bias in D_m (and low bias in N_w) relative to GR but N_w-D_m behavior is similar from two independent measurements
- Questionable behavior of 2ADPR near D_m=3.0 mm is due to inclusion of 2AKa, which limits D_m≤3.0mm; 2AKu does not exhibit such peaked behavior at high D_m

DPR Sensitivity



- About 35% more matched volumes included at 3 dB lower DPR sensitivity threshold
- Very slight reduction in D_m bias

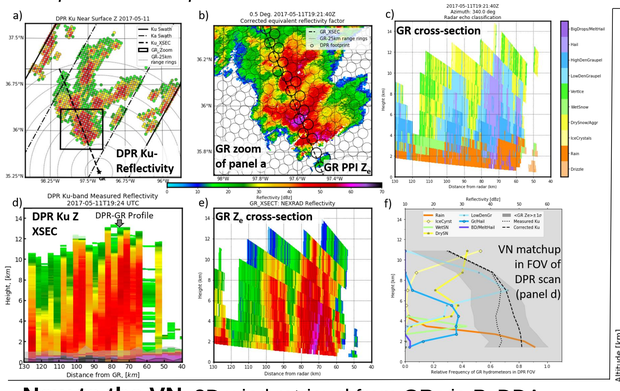
Rainfall Retrieval (DPR/GMI)

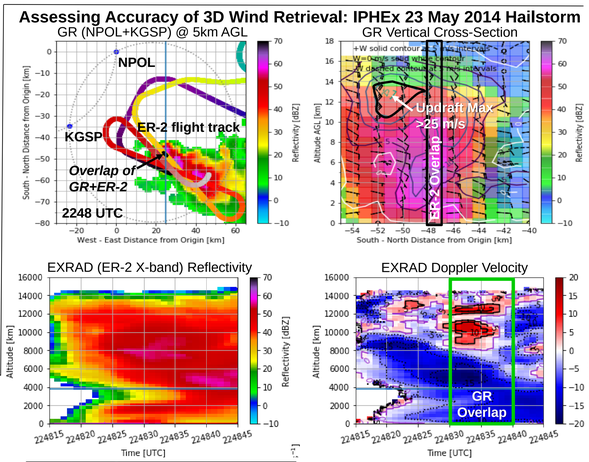


GR RC: (Cifelli et al. 2010)

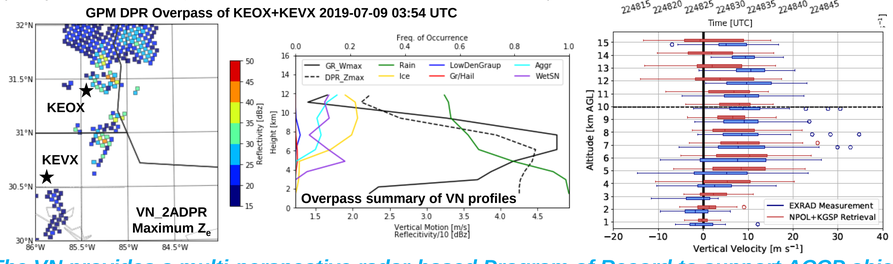
GPM VN: A resource for future precipitation science and ACCP

Using VN to characterize multiple scattering and non-uniform beam filling to improve 2ADPR precipitation retrievals
Example: DPR overpass of intense convection in northern Oklahoma





New to the VN: 3D wind retrieval from GR via PyDDA (Shapiro et al. 2009, Potvin et al. 2012, Jackson et al. 2019)



Particle v_t correction: Black et al. (1996)

The VN provides a multi-perspective radar-based Program of Record to support ACCP objectives

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